1. An integrated motor and magnetic bearing, comprising:

a rotor comprising a plurality of permanent magnets; and

a stator comprising a plurality of independently controlled coil segments magnetically coupled to said permanent magnets.

2. An integrated motor and magnetic bearing as claimed in claim 1, said coil segments comprising a plurality of coil phases.

3. An integrated motor and magnetic bearing as claimed in claim 1, further comprising a first radial position sensor disposed in or adjacent to a clearance gap between said rotor and said stator for sensing the position of said rotor with respect to said stator along a first axis, and a second radial position sensor disposed in or adjacent to said clearance gap between said rotor and said stator for sensing the position of said rotor with respect to said stator along a second axis.

4. An integrated motor and magnetic bearing as claimed in claim 1, said integrated motor and magnetic bearing capable of providing simultaneously both rotational torque and radial bearing force.

5. An integrated motor and magnetic bearing as claimed in claim 1, said integrated motor and magnetic bearing permitting dynamic application of rotational torque and/or radial force.

6. An integrated motor and magnetic bearing as claimed in claim 1, said integrated motor and magnetic bearing capable of providing rotational torque and/or radial bearing force.

7. An integrated motor and magnetic bearing as claimed in claim 1, wherein at least one said sensor is selected from the group consisting of: an encoder, a Hall effect transistor, and a device adapted to measure a voltage generated at at least one said coil segment.

8. An integrated motor and magnetic bearing as claimed in claim 1, said integrated motor and magnetic bearing operating as a DC device.

9. An integrated motor and magnetic bearing as claimed in claim 1, wherein said clearance gap is sized so as to provide vibration isolation.

10. An integrated motor and magnetic bearing as claimed in claim 1, wherein at least one redundant coil segment is provided for fault tolerance.

11. An integrated motor and magnetic bearing as claimed in claim 1, wherein said integrated motor and magnetic bearing is adapted to provide off axis-operation and/or run-out cancellation.

12. An integrated motor and magnetic bearing as claimed in claim 3, further comprising a controller receiving input from at least one said sensor and, based on said at least one input, controlling the current delivered to at least one said coil segment.

13. An integrated motor and magnetic bearing as claimed in claim 12, wherein said controller is adapted to permit off-axis positioning.

14. An integrated motor and magnetic bearing as claimed in claim 1, wherein said rotor has a toothless configuration.

15. An integrated motor and magnetic bearing as claimed in claim 1, further comprising a thrust bearing adapted to provide axial thrust.

16. An integrated motor and magnetic bearing as claimed in claim 1, wherein said rotor and said stator are configured such that the attraction of said rotor to said stator provides axial thrust.

17. An integrated motor and magnetic bearing as claimed in claim 1, wherein said plurality of coil segments is at least three coil segments.

18. An integrated motor and magnetic bearing as claimed in claim 2, wherein said plurality of coil phases is at least two coil phases.

19. An apparatus for manipulating a shaft comprising:

two integrated motor and magnetic bearing assemblies, each said assembly comprising a rotor and a stator, each said rotor comprising a plurality of permanent magnets, and each said stator comprising a plurality of independently controlled coil segments magnetically coupled to said permanent magnets; and

a shaft;

wherein each said assembly is disposed along said shaft.

20. An apparatus as claimed in claim 19, further comprising an independent control device for each said assembly, thereby allowing independent movement of the shaft with respect to each said assembly.

21. An apparatus as claimed in claim 20, wherein said control devices are adapted to permit warping or off-axis pointing through the axial plane by independent positioning of the suspended shaft in each said assembly.

22. An apparatus as claimed in claim 20, wherein said control devices are adapted to permit rotation of said shaft off the central axis.

23. An apparatus as claimed in claim 19, further comprising a thrust bearing adapted to provide axial thrust.

24. An apparatus as claimed in claim 20, wherein at least one said rotor and at least one said stator are configured such that the attraction of said rotor to said stator provides axial thrust.

25. A method for providing integral electromagnetic motor and bearing functions comprising:

sensing a first radial position of a rotor, said rotor comprising a plurality of permanent magnets, with respect to a stator along a first axis, said stator comprising a plurality of independently controlled coil segments magnetically coupled to said permanent magnets;

sensing a second radial position of said rotor with respect to said stator along a second axis; and

delivering current to at least one said coil segment, the amount of said current based on at least one said sensed position.

26. A method as claimed in claim 25, further comprising providing axial thrust along a third axis, said third axis crossing the plane of said first and said second axes.